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GALLIUM

Element Symbol: Ga
Atomic Number: 31

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The discovery of gallium has great significance to Mendeleev's development of the periodic table as it was the first new element discovered since Mendeleev's 1869 table. In 1871 Mendeleyev had prepared a table of known elements leaving gaps for those "elements yet to be discovered", one of these being eka-aluminium. Four years later, a Frenchman Paul Emile François Lecoq de Boisbaudran discovered this element spectroscopically (two violet lines) during an examination of a zinc blende from the Pyrenees. Lecoq's newly discovered element was found to have an atomic weight of 69 and appeared to have the properties that Mendeleev had predicted for eka-aluminium. However, when made aware of Lecoq's calculated specific gravity of 4.7, Mendeleev replied that it was incorrect since it didn't agree with his predicted value of 5.9 and suggested he repeat the experiment with another sample. Upon Lecoq repeating the experiment, Mendeleev was found to be correct!

Upon its discovery, Lecoq had named this new element gallium after Gallia, which makes sense since he was a Frenchman. But it was also suggested at the time that Lecoq might have been less patriotic since Le coq in French means 'cockerel', which translates into Latin as gallus. However, Lecoq apparently denied this in 1877.

Elemental gallium is not found in nature. Among other minerals, gallium is present as a trace component in bauxite, the ore of aluminium. This is not surprising since gallium is in the same column of the periodic table as aluminium, and would be expected to have similar chemical properties. As a consequence, the major commercial source of gallium is the Bayer process (the process of refining bauxite to aluminium oxide). Operating as a small sidestream process, gallium is extracted from the alkaline liquor of the Bayer process and subsequently returned to the alumina refinery for reuse.

One of the fascinating properties of gallium is the large liquid range from melting to boiling point (29.8 to 2,204°C) - which is one of the largest of any element. Not surprisingly, it is used in high temperature thermometric applications. On a more historical, and indeed sinister, application, gallium was used as a 3 molar % alloy in the plutonium cores of the first and third nuclear bombs (Gadget and Fatman bombs), to help stabilize the plutonium crystal structure.

However, gallium's most important modern day use is in electronic devices. Gallium arsenide semiconductors circuits can operate as high as 250 GHz, outstripping those of silicon by a hundredfold. Gallium nitride and indium gallium nitride produce blue and violet light-emitting diodes (LEDs) and diode lasers - what would we do without our Blu-ray players!

Semiconductor use is now almost the entire world market for gallium. However, new uses in alloys and fuel cells continue to be discovered. For example, the current record efficiency for a concentrated photovoltaic technology multi-junction solar cell is a three-junction gallium indium phosphide/gallium indium arsenide/germanium cell at 41.6%. Yes, the future for gallium is still very bright.

Provided by the element sponsor Luke McGuiness

ARTISTS DESCRIPTION

The blue/mauve background reflects its characteristic spectrum and its use in LED and blue laser technology. Since it is radioactive and used as a tracer in radiology, the symbol for radioactivity is included. The cockerel represents Lecoq, the chemist who discovered Gallium. Although he claimed he chose Gallium to symbolise France (Gallia in latin), his surname translates to "The Rooster" and it has been debated that he was also referring to it.

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